Lambda Expressions in Java
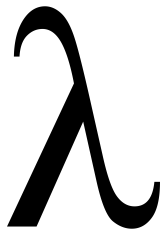
Erhan Bagdemir

bagdemir.com - Follow on @ebagdemir

February 9, 2015

Today's Agenda

λ

- ▶ Definition of Lambda.
- ▶ Lambdas in Java.
- ▶ Lambda in Action.
  - ▶ forEach(...) and default implementations
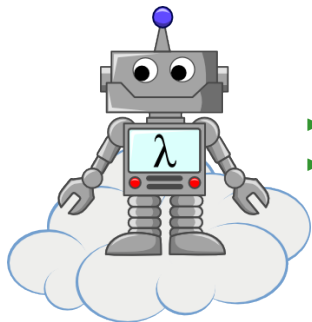 - ▶ Streams
  - ▶ Parallel Streams.

Lambda Expressions: Definition of Lambda

- A formal system for expression the computational behaviour.
- Invented by Alonzo Church in 1930.
- Lambda expressions consist of many parentheses i.e in Y-combinator:

$$Y = \lambda f.(\lambda x.f(xx))(\lambda x.f(xx))$$

Lambda Expressions: The Idea, behind

- ▶ Functions are first-class citizens.
- ▶ Lambda expressions are high order functions:
  - ▶ They take other functions as parameter.
  - ▶ They may return functions.

Lambda Expressions: Java 8

Some examples of function definitions:

- **in math f(x) = x + 1**
- in LISP: **(lambda (x) x + 1)**
- in C++11: **[](int x) { return x + 1; }**
- in Scala: **x => x + 1 or just _ + 1**
- in Java 8: **(int x) -> x + 1**

Lambda Expressions: Type of Lambda Expressions

The type of the lambda expressions are defined in **java.util.function**

```
Function<Integer, String> toStr = x -> Integer.parseValue(x);
```

You can pass lambdas as parameter:

```
final Double forNetPrice = 50.0d;
final Function<Double, Double> withVAT = x -> x * 1.19;
prepareForShipment(withVAT, forPrice);
```

Lambda Expressions: Type of Lambda Expressions

If there is no functional interface in **java.util.function** package for
your usage, create your own:

```
@FunctionalInterface
public interface WorkflowLambda {
    IAsset execute(String clientId, String userId, MetadataView
        view);
}

WorkflowLambda workflow = (clientId, userId, view) ->
    executeWith(clientId, userId, view);
```

▶ Call *Functional Interfaces* or *Single Abstract Method* interfaces.

Lambda Expressions: Scope of Lambda Expressions

Scope of the lambda expressions, the scope of the enclosing type:

```java
@Service
public class OrderManagement {

  @Inject
  private ShippingCostService scService;

  private void calculateOrder() {
    /* final */ double vatRate = vatService.getVAT(Country.DE);
    Function<Double, Double> total = x -> (x * vatRate) +
        this.scService.getCost();
  }
}
```

The local variables can be referenced by lambda expression as long as they are **effective final**.

Lambda Expressions: Method References

We can use the methods of existing classes as lambda expressions.
Method references are syntactic shortcut to the lambda expressions:

```
// static <T> void sort(T[] a, Comparator<? super T> c)

Collections.sort(myList, (firstInt, secondInt) -> firstInt -
    secondInt);
Collections.sort(myList, FooComparator::compare);

// if we'd an existing comparator
public class ExistingComparator {
  public static Integer compare(Integer first, Integer second) {
        return first - second;
  }
}
```

Lambda Examples: forEach()

▶ Collections know how to iterate through their elements.
▶ It's a better style than imperative external loops, which provides functional polymorphism.

```java
final List<Integer> myList = new ArrayList<>(3);
myList.add(1);
myList.add(5);
myList.add(2);

myList.forEach(System.out::println);
```

An new method in "Collection" interface without breaking code ?

Lambda Examples: Default Implementations

Interfaces may have **default** implementations:

```
public interface Dog {

    public void wagTail();

    public default void bark() {
        System.out.println("Bark!");
    }
}
```

- The interfaces may contain static methods as well.
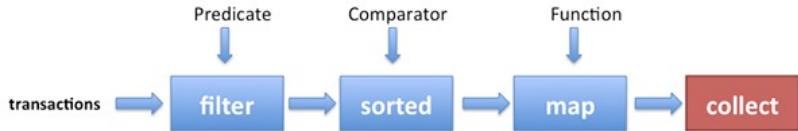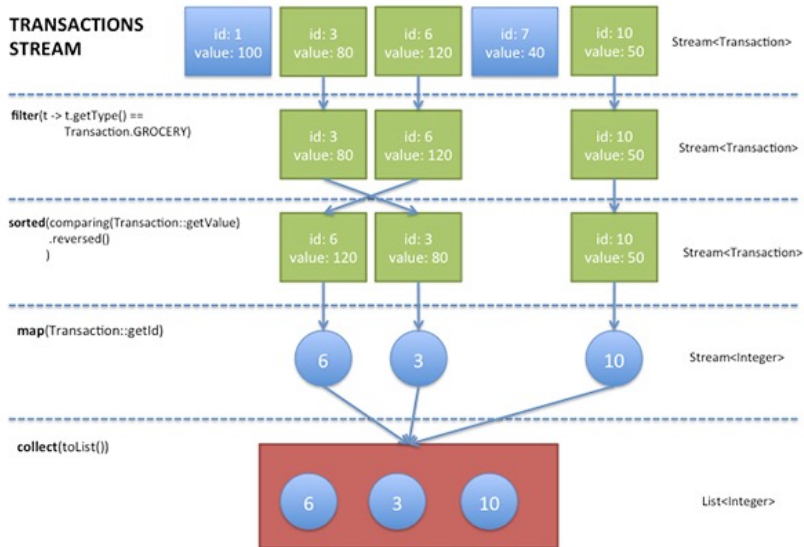
Streams

Lambda Examples: Streams

- Streams represent a sequence of elements which supports different kind of operations to perform computations on these elements.
- There are two types of operations:
  - Intermediate Operations (filter, sort, etc.).
  - Terminal Operations (collect, forEach, reduce, etc.)
- Stream features:
  - No storage.
  - Functional in nature (No side-effects).
  - Streams are lazy (except sort).
  - Allowed to be unbounded.
  - Consumable.
- Streams are monads!

Lambda Examples: Stream Pipelines

Processing pipeline consists of a source, intermediate operations and a terminal operation.

Lambda Examples: Stream Processing

Lambda Examples: Streams

▶ Stream sources: Arrays, Collections, Generators and I/O Streams, e.g:

```
try (BufferedReader br = new BufferedReader(new
    InputStreamReader(is))) {
    br.lines().forEach(System.out::println);
}
catch (Exception e) {
    System.out.println(e.getMessage());
}
```

▶ After terminal operation, the stream is considered to be consumed.

▶ The intermediate operations are lazy and always return a new stream. (see Example 6)
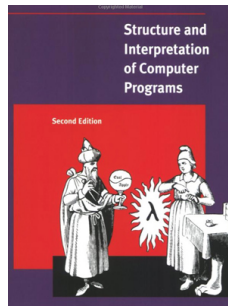
Lambda Examples: Code Samples

Some examples (https://github.com/bagdemir/java8-training) :

- ▶ Generators
- ▶ Comparators
- ▶ File I/O
- ▶ Regular Expressions
- ▶ Reducer
- ▶ Collectors
- ▶ Parallel Streams

Lambda Examples: Finish

Functional Programming (in Scala)

Structure and Interpretation of Computer Programs

Links

Lambda Quick Start
Oracle.com : http://bit.ly/1eR0we0
-
Streams
Oracle.com : http://bit.ly/1eh4aZo
Oracle.com : http://bit.ly/1ustKrM
-
Contact
https://github.com/bagdemir
https://twitter.com/ebagdemir
http://www.bagdemir.com